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Science Blogging: Networks, Boundaries and Limitations

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ABSTRACT

There is limited research into the realities of science blogging, how science bloggers themselves view their activity and what bloggers can achieve. The 'badscience' blogs analysed here show a number of interesting developments, with significant implications for understandings of science blogging and scientific cultures more broadly. A functioning and diverse online community (with offline elements) has been constructed, with a number of non-professional and anonymous members and with boundary work being used to establish a recognisable outgroup. The community has developed distinct norms alongside a type of distributed authority and has negotiated the authority, anonymity and varying status of many community members in some interesting and novel ways. Activist norms and initiatives have been actioned, with some prominent community campaigns and action.

There are questions about what science blogging – both in the UK and internationally – may be able to achieve in future and about the fragility of the 'badscience' community. Some of the highly optimistic hopes which have been associated with science blogging have not been realised. Nonetheless the small group of bloggers focussed on here have produced significant achievements with limited resources, especially when one considers this in the context of community values as opposed to some of the expectations attached to science blogging within scientific cultures more broadly. While the impacts of this science blogging community remain uncertain, the novel and potentially significant practices analysed here do merit serious consideration.

KEY WORDS: blogging, science communication, media, activism

Introduction

Science blogging is getting significant attention. A number of prominent scientific journals have published articles on science blogging (e.g. Bonetta 2007, Schmidt 2008) and *Nature* has recently published an editorial about blogging (Nature 2009) as well as featuring a regular column 'from the blogosphere'. Usually written by a prominent science blogger these articles are for the most part written as a guide for scientists to the world of science blogging.

Science bloggers' online activism came to wider public attention in the UK in 2010, with their contribution to the events of the celebrated Singh-BCA libel case especially prominent. In this context, science blogging was increasingly discussed as a new and novel way for scientists and others to take up the fight against perceived bad or pseudo science and problematic libel laws. The origins of this important case lie in science writer Simon's Singh's 2008 *Guardian* article on chiropractic which criticised the British Chiropractic Association (BCA). The BCA objected to one of Singh's statements and started libel proceedings against him. This case drew the attention of UK-based science bloggers who started campaigning about the Singh case and about libel reform in general. In April 2010 the BCA eventually dropped the libel proceedings. The blogger and lawyer David Allen Green ('Jack of Kent'), writing together with Robert Dougan (who represented Singh), argued that the attention of bloggers played a very significant role in this case (Dougans and Green 2010).

This paper contributes to the literature on science blogs (discussed below): focusing on a particular community of bloggers which arose through the community of commenters on the 'badscience' blog and newspaper column of the UK science writer Ben Goldacre. Through a brief description of the types and communities of science blogs and a qualitative study of one particular science blogging community, we aim to answer some key questions with significance for scientific cultures well beyond this community: how do science bloggers see themselves and their activity, especially in relation to the activism that characterises the community we will focus on? Who blogs and why? How has a community been constructed? How do they construct their authority through their writing? How do they navigate the various risks surrounding libel and identity disclosure? And, lastly, what expectations and hopes are attached to blogging – by bloggers and others – and can they be realised?

The article begins by laying out its theoretical framework, drawing on ideas of boundary work and other practices used in the construction of scientific credibility

and authority. It then engages with Shanahan's (2011) work on science blogging in order to think through the idea of networked flows. The article lays out its context – discussing the main types and structures of science blogging that were present during its writing – and then details a methodology which deploys online ethnography alongside a qualitative survey. We consider some characteristics of' badscience' bloggers, before moving to analyse their views on activism, risks and authority. We conclude that – while the impact of this community remains uncertain – the practices analysed here are sufficiently novel and have sufficiently significant potential impacts to merit serious attention.

Theory: boundaries, credibility and authority

The nature of blogging potentially challenges some of the traditional roles of science writing. Writers can no longer assume that their authority is unquestioned and need to find ways of making their voices heard, while the risks of blogging drive many science bloggers to write anonymously. However, we can identify common themes between blogging and more traditional types of science communication and – through referring to some past and developing literature – will be able to situate our work in the broader research context.

Blogging can be seen through the perspective of boundary work (Gieryn 1999) where the members of this blogging community actively engage in demarcating proper science from the 'pseudoscience' which very often (and especially so in the community we investigate in this paper) is the subject of their posts. In this, science blogging is probably an even more visible example of boundary work than has been found in other studies on more traditional popular science work such as popular science books (Riesch 2010; Leane 2007; Cassidy 2006; Nieman 2000), Fred Hoyle's life-from-space theory (Gregory 2003) or science communication in general (Bucchi 2002).

The fact that the community this paper focuses on is called 'badscience' bloggers (named after and inspired by Ben Goldacre's Guardian column of the same name) suggests boundary work to construct a collective barrier against 'bad', pseudo- and non-science. The nature of blogging however challenges a simple theoretical identification of the 'badscience' blogs with boundary work, because the community is largely anonymous and not necessarily only composed of those with a professional interest in science. Some of the motivations that Gieryn identifies behind boundary

work, such as "acquisition of professional authority and career opportunities" (Gieryn 1983) cannot be universally present here. Instead this community, its aims and its ways of operation call for a closer look at how identification with the scientific enterprise shapes boundary work done by even those without a (visible) stake within it.

There are therefore two strands that need looking at further: the construction of a scientific identity through adherence to scientific norms in community blogs and the manner through which scientific authority (and thus an identity of being part of the wider scientific culture) is managed and maintained in the absence of visible conventional credentials. There are, we will argue, some novel techniques and innovations that are being used by the science bloggers studied here, partly as responses to some of the new challenges and opportunities unique to blogging and to the ways in which bloggers' boundary work needs to negotiate new issues of online credibility.

Without necessarily having recourse to institutional affiliations with credible research institutions - either because they write anonymously or because it is not just credentialed scientists who blog about science - science bloggers need to find ways of persuading their readers that they know what they are writing about. Traditionally credibility is categorised by 'source', 'message' and 'media' credibility (see Flanagin et al. 2008; Rieh and Danielson 2007). Anonymous or unaffiliated science bloggers however can only really rely on the credibility of the message. As Flanagin et al. outline, online credibility compensates for this by networked processes of social endorsement. Science bloggers' online boundary work and credibility construction therefore has to focus on making the message itself persuasive through emphasis on scientific validity ('letting the facts speak for themselves') and back this up through a distributed authority which works through a network of referrals from already trusted sources and through referencing authoritative sources (such as peer reviewed scientific articles).[1] This also corresponds with traditional scientific norms on peer review or Merton's (1973) norm of *universalism*, which science bloggers rely on to validate their work as scientific, as will be outlined below.

As will be discussed below, the ability of those within and outside the group to read, comment on and challenge blog posts has come to serve as a form of informal peer review. Credibility thus begins to move beyond more formal structures and instead become a property of the network. This paper will therefore discuss how a

type of networked authority is developed. Rather than writing from personal authority (something that even community members with senior positions are critical of) blog posts gain authority through their position in the network.

Shanahan (2011, 910) uses an example of an interaction sparked by Ed Yong's blog to propose the analogy of

> two different fluids…flowing past one another. The boundary layer is the area where the fluids interact and have an impact on each other's flow patterns and temperature…From this analogy, it is proposed that a boundary layer is a place where members of boundary social groups are both present and have an influence on one another.

While sympathetic to Shanahan's analysis, this paper will place greater emphasis on the role of networks in boundary work and, in particular, on the construction of a type of networked authority which can take precedence over formal qualifications. In the case analysed here, networked processes play important roles in constructing, maintaining and pulling apart boundaries.

Types of science blogging

In analysing science blogging, we have noted a number of distinct though sometimes overlapping categories. Analysing the relative prevalence of blogs in each category would be beyond our scope here, so this list is meant to be indicative of some different types of science blogs apparent to us at the time of writing (see also Bell (2012) for a fuller description of science blog communities and the difficulties of getting an empirical estimation on how many people, and who exactly, blog on science). Perhaps most prominent (at least in terms of audience and budget) are mainstream media blogs such as Guardian Science (hosted by the *Guardian* newspaper) and *Bang Goes the Theory*[2] (a blog associated with a BBC popular science programme)

Moving beyond the mainstream media, there are a number of institutional blogs. These include the Institute of Hazard, Risk and Resilience blog[3] (run from this Institute at Durham University) and the Cancer Research UK Science blog[4]. These blogs focus on public-orientated science communication by particular scientific or

social scientific institutions and often utilise the skills of professional science communicators.

There are also blogs that focus on the bloggers' own academic research. This blogging is more often carried out by practising scientists or researchers, and is often aimed more at peers than at the general public.

There are, additionally, a number of what might be viewed as non-science blogs which still talk about science. For example, the legal blogger Jack of Kent[5] has gained a large following of science bloggers through his analysis of the Singh libel case and he has therefore become a member of this community. There are also more personal blogs such as grrlscientist[6], where scientists blog but (in addition to and as part of significant discussions of science) have often considered 'personal' issues.[7]

All these different categories can and often do overlap, as bloggers can use their blogs for different purposes. For example bloggers who mainly blog about their research as a way of communicating with other scientists can also add more personal posts or posts more accessible to a wider audience. The 'badscience' blogs we will analyse below span several of the above categories – for example, one blogger regularly blogs at the *Guardian*. Mostly, however, the 'badscience' blogs are personal blogs that are not tied or only loosely tied to a news or institutional outlet.

Science blogs can also be broadly grouped according to the formal or informal networks to which they belong. The 'badscience' group that we will focus on in this paper is a relatively loose and informal group of individual bloggers who often read each others' entries and comment on similar issues. The community feel is reinforced through the frequenting of the community forum, but this network otherwise lacks formal gatekeepers determining who is and is not part of the group. In the wider world of science blogging, there seem to be three other groups that stand out. Mainstream media blogs are mentioned above, but there are also Seed Magazine's *ScienceBlogs* (largely US-based, though with prominent UK members) and *Nature Network* which carries prominent and mostly research-focussed blogs (for a more detailed description of the science blog 'cliques' see Bell, 2012). Membership of these last two networks is much more rigidly defined than the 'badscience' blogs through the organisations that host the blogs and also control the number and quality of their bloggers, while of course the mainstream media blogs are affiliated with their host organisations and are therefore even more tightly controlled. However the boundaries between networks are rather fluid. There are bloggers who are part of several of these communities, and

Seed Magazine faced several recent defections. However fluid the boundaries between communities are, there are nevertheless more or less clearly defined communities visible when we look at interlinkages and inter-blog conversations. This is the sense in which we talk about a 'badscience' community.

This community arose from and draws heavily upon Goldacre's *Guardian* column and blog (and, subsequently, book) of that name. In 2005, a community began to emerge around Goldacre's blog, enhanced through the development of a forum on the site in December 2005.[8] Subsequently a number of people in/related to this community began to blog, and were encouraged to do so. In contrast to some of the other science blogging groups, this community is characterised primarily through its focus on activism (to be discussed below) and its bottom-up organisational structure. Aside from blogging on science and adhering to some shared group norms that are still in the process of developing there are no formal barriers for membership and no formal authority figures to police the network's boundary.

Methodology

Of the various blogging communities the 'badscience' community was chosen for analysis primarily because of our prior familiarity with the bloggers, giving us an understanding of the issues and concerns motivating them as well as (through this personal connection) allowing us easier access to a community that is understandably (see below) worried about anonymity issues. Another issue that makes this community particularly interesting, and which attracted us to interact with it informally in the first place, is its emphasis on science activism, demonstrated on a superficial level by the rhetorical boundary work inherent in the term 'badscience' itself (though 'badscience' was chosen by Goldacre as a name for his blog and *Guardian* column long before the community established itself).

The study builds on an ethnographic background in order to engage with and analyse this community through a qualitative survey. We focus on the functioning of this community - and other relevant aspects of science blogging - through to late 2010.

Ethnography

The background element of the study is ethnographic in focus – both authors have been regular contributors to the 'badscience' forum and community for several years.

Both of us have contributed to blogs linked to this community and one of us has responded to Goldacre's call for more science blogging by establishing his own science blog.[9] We have therefore ourselves lived through the events that established and developed the community. Our own blogging will not feature in the main analysis itself due to worries about conflict of interest and anonymity (which will be discussed in more detail below). As with most ethnographic research, while this active participation has given us a unique insight into and understanding of the community, it also makes it difficult to report research findings as a distant and neutral observer. Therefore, while the experience gathered through being active members of the community has informed the direction of our research questions and of course coloured our own perceptions of the challenges and issues faced by science bloggers, this paper draws on an email survey to members of the community.[10]

Qualitative survey

A total of 32 bloggers were approached, of whom 13 completed the survey – a response rate of about 40%. As the core of this community is relatively small, we feel that these 13 blogs provide a useful overview of the community at large and we will therefore use our survey to characterise some aspects of this community in the next section.

The sample of blogs was selected through our own prior knowledge of the bloggers within the community. Initial emails also asked respondents to identify other members of the 'badscience' blogging community to minimise the risk of missing anyone out. This method did not reveal any blogs not approached in the initial round, and we are therefore confident that our sample did adequately encompass this community – at least insofar as it self-defines its membership.

Email interaction was chosen partly because of ease of access, as the bloggers were distributed throughout the UK (see also Kivits 2005), but also to ensure anonymity for those who may have been nervous about meeting face-to-face. The reasonable response rate and in-depth answers from many participants suggests that this was an appropriate method to use in this context.

The questions put to the bloggers focussed on their blogging habits (how often they blog, what types of science they blog about and how they interact with other bloggers), their reactions to readers' comments, their navigation of issues such as anonymity, scientific authority and threat of libel actions, their views on how

blogging interacts with the mainstream media, and finally on the activist focus of this particular community. We chose these foci in order to: learn about the practises of community members; assess the impact of some key issues within this community; and investigate the effects, successes and failures of the community's activist focus. In the section below we will focus on these themes. The answers from this survey have been treated as qualitative data and were analysed and coded using the qualitative data analysis software NVivo.

Our ethnographic experience of this community has given us a broad understanding of community functions and norms. Hine (2000, 148) points out that 'why do they do it' can seem 'bizarre' if one does not have a sense of the shared understandings which render this type of production meaningful. Importantly, our ethnography gave us a sense of these shared understandings which helped to give meaning to the activities that community members were engaging in. A qualitative survey of this community then – while response rate is too low to assume that coverage is either complete or representative – allowed us to probe community members on key questions, deepening our understanding of significant community features and activities. An earlier draft of this paper has been sent to the participants to seek their opinion on the information presented, the quotes attributed, and to check whether in their opinion our representation of the community is a fair reflection of it. Those who responded all agreed, insofar as they commented on the topic, that this is a fair representation of the community and were happy with the quotes used.

As Hine (2000, 23-4) argues, if a community is real enough to allow ethnographic research then it is also real enough for concerns about the invasion of privacy to be an issue. With this in mind, our ethnography has focussed on discussions in what may be viewed as public spaces (for example, blog posts and public forum discussions). We have deliberately avoided referring to personal details revealed in what may be viewed as more private or semi-private spaces (for example, personal Twitter accounts). While this will mean that there are aspects of this community's working which we cannot include in this paper, this is a necessarily sacrifice in order to avoid inappropriate invasion of privacy.

Informed consent was obtained from participants in our survey. We have been careful to anonymise participants where statements or opinions appear sensitive or – where quotes with a higher risk of controversy are tied to particular identities – we have sought informed consent to do this.

Characteristics of the 'badscience' blogs and bloggers

The bloggers participating in this research have a diverse range of motivations. Social networks are clearly important here. The most popular reason for starting a blog was recommendation by an acquaintance, and Ben Goldacre's recommendations were particularly influential. Other reasons (cited by two participants) included frustration with poor quality science reporting and to practice communication skills. A desire to share their views with a broader range of people was cited by two participants and Brainduck's earliest blog post cites this as a reason for blogging.[11] One blogger also cites activism as a motivation – and it was success in this that 'hooked' them on science blogging.

Community was important, but this was to a significant extent a virtual community and actions in this realm were therefore important to maintaining its functioning and boundaries. The majority of participants reported some interaction with other blogs. This community frequently used some of the media discussed above, with the 'badscience' forum and Twitter being the most common mediums for discussion and engagement, along with commenting on (other) blogs. It would be interesting to know how these interactions are developing over time (one participant noted 'Twitter has replaced comments as the primary form of feedback to the site'). Interactions with other blogs were largely viewed as positive (including links from other blogs) although one participant reported that 'I have had the odd comment by a blogger who feels that I should be engaging in more activism on a particular issue, or that I have transgressed a group shibboleth.' Two participants reported other people writing for their blogs and several have themselves written for other blogs. Face-to-face interactions were reported by five participants (although one of these noted that 'geography doesn't permit this as much as I would like').

Hine (2000,19) argues that studies of online communities may focus on shared social practices instead of physical boundaries. In focusing on a community of bloggers, that is broadly the approach we have taken here. However, we would emphasise that this does not constitute a move beyond place. Instead, our research suggests that there is a distinctly place-based element to the 'badscience' blogging community, with respondents to our questions overwhelmingly based in the UK and largely based in one area of the UK. This online community is still a geographical one and is still linked in particular ways to particular places. This is partly due to the

connection with (UK-based) Goldacre – and his column in the UK's *Guardian* newspaper – on whose recommendation many bloggers started. But it is also a result of bloggers responding to issues that are of primarily (though not exclusively) UK concern – e.g. responding to UK newspaper science coverage or, in the two examples we consider below, responding to UK (or England and Wales) political parties' science policies and a prominent English libel case. Therefore, even though blogging is often viewed as a technology that transcends national boundaries, the areas of interest of the bloggers themselves largely follow more national conversations. Blogging communities such as the one in our study are still very much influenced by the places in which they are situated and this can have significant effect upon the boundaries of such communities.

In terms of community/reader reactions, nine of the participants reported positive and supportive comments. These comments are often linked to readers being themselves of a similar mind or part of related communities, although a blogger also noted that commenters drawn in from Googling a particular product were 'grateful at not being conned into parting money with what seems to be a fraudulent organization.' Eight respondents, though, referred to at least some negative and at times abusive comments.[12] The most common way of responding to such comments (six participants) was to reply politely to them. Four participants state that negative commenters often made mistaken assumptions. One blogger noted that, because of the other risks they faced, 'anon internet nutters who often aren't even in the UK & don't know where I am just doesn't score that highly on my things to worry about scale.' Science Punk raised issues of community, arguing that 'I get negative comments, but most are from those with an agenda and don't reflect on my writing. It would be a far worse thing to lose the respect of other community members than Joe Nobody of Bigotsville, Texas.' Several bloggers noted potential benefits of negative comments. For example, one blogger stated that 'if I think someone is making a genuine point and may be open to debate I will usually discuss the issue with them' and another noted 'I get constructive criticism, and people pointing out minor errors I deal with these by correcting my post and acknowledging the correction.'

The wider discussion of community and collaboration did not, notably, mention any form of central organisation. It appears that the community here is able to organise in a decentralised fashion – without any central authority coordinating bloggers. Indeed, one participant argued that '[i]t is not for anyone person to try and

come up with a coherent stance on anything in the blogosphere. That is it's chaotic beauty in a way to try and define a set prescriptive role would be contrary to the spirit of blogging.'

The people who responded to Goldacre's call for blogging and activism were an eclectic mix. Although all shared an interest in science, not all were scientists and some did not have an extensive science education. Four of the twelve people who gave their education level had a PhD, three had other postgraduate qualifications, four had a BSc and one had taken science to GCSE level. Occupation varied widely, from scientist to 'nope'. Seven of the eleven who answered this question had jobs in STEM and two of them worked in sales. Two participants listed writing and/or journalism as part of their job. The participants who specified their gender are predominantly men.

However, despite these differences, through modelling themselves on or taking an impetus from Goldacre's very successful writing a community ethos developed which emphasised reliance on evidence, accuracy and general 'skeptical' or 'critical' thinking. This was often coupled with a campaigning element (most often against 'alternative' medicine or other 'badscience'). As noted above, community was a prominent reason behind participants starting science blogs. A number of people started blogging due to the recommendation of an acquaintance (who in most cases was Ben Goldacre). The community that came together through the forum also included a smaller number of people who already ran successful science blogs and were in turn attracted to the community's established blogging culture.

There was a great deal of variation in stated frequency of blogging. The modal response (six participants) was a frequency of about once a week, but several participants cited variable frequency and two reported blogging just a few times a year.

Topics covered in addition to science were also diverse. Five participants reported blogging about religion, with three reporting blogging on libel laws and two on politics. Topics ranged from bookshops to philosophy to university politics. The great majority of respondents, though, reported that their blogging was either all or mostly science-related (an unsurprising result, given that this research focuses on science blogging). The most common aspects of science covered were 'alternative' medicine, health and 'badscience', with other topics including psychology and the media's treatment of science. Again, though, there was considerable variation in the

types of science covered, with bloggers discussing topics ranging from fluid dynamics to lasers.

The heterogeneous nature of the community we found differs from some of the usual characteristics associated with Gieryn's (1999) concept of boundary work. The resources and epistemic authority the blogging activism seeks to protect, by building a rhetorical boundary between good and bad science, is part of a wider community identification of the bloggers with science as a shared worldview rather than a professional legitimation strategy. In a novel aspect of this type of boundary work, going beyond some of the motivations Gieryn (1983) identifies, these resources appear to be more ideational than institutional. For example, they are linked to concepts of science and evidence more than particular institutions.

Bloggers' views on activism, risks and authority

Dealing with authority and credibility

The writers' authority and credibility was negotiated in complex ways, forming an especially interesting and novel aspect of this community. There was a loose consensus that one does not need to be a specialist to blog on a topic and thus anyone can write a science blog. One participant actually sees potential benefits in this as 'if someone isn't a "scientist" it could be an interesting project for them to find that scientific thinking may be appropriate to other parts of life/society.' However, there was also an emphasis on the importance of a critical approach and self-awareness in order to produce credible writing

> I think it's important that any given blogger understands the limitations of their own knowledge and declares when they're talking outside of their expertise. This doesn't mean not everyone can write [a science blog], but it may mean getting help/advice from others if talking about things that aren't in their own domain (as I have done myself).

One respondent raised the possibility that – if the blog is open to comments – problematic approaches will be highlighted in the comments.

There is a group norm in this community of letting the evidence talk for itself – because if an argument is correct, it does not matter who makes it - reminiscent of the influential and oft-cited Mertonian norm of universalism (Merton 1973). One of

the challenges in writing a science blog is therefore dealing with your own authority. When writing about complex scientific arguments, the blogger needs to navigate a fine line between claiming authority as someone who knows what they are talking about on the one hand and on the other conforming to this group norm where the focus is on the evidence rather than the writer.

Following from that norm there was a broadly negative perception of writing from authority, with such writing sometimes viewed as actively damaging to one's credibility. This includes those who might be seen to be in positions of authority. For example, a science blogger who is also a senior scientist argues that 'Writing from authority destroys your credibility. I justify writing about things outside my area because I understand statistics and the nature of evidence.' A blogger writes that 'authority comes from linking to primary sources and data not from my expertise or otherwise.' Yet this argument is not always sufficient. Sometimes when the writer presents complex statistical arguments for example, which a negative commenter simply refuses to recognise or believe, issues of authority are unavoidably raised.

Significantly, the science blogging analysed here seems unusual in popular science genres in that almost all authors downplay their individual expertise and authority. One participant illustrated this well with a self-effacing statement that although they 'blog about things I understand well… you perhaps wouldn't always know it!' It is emphasised that knowledge and personal authority is not enough.

Insofar as authority is in play here, it attaches less to individual expertise than to the position of a blogger in a network of other blogs, comments and published research. By linking to original sources, being open to corrections in comments and being part of this community of bloggers, there is a type of decentralised, distributed or networked production of authority. Bloggers who lack the authority of a senior status (or simply blog anonymously and without reference to their professional status or lack thereof) nonetheless gain an unconventional form of authority through their position in the community and in broader networks. As argued in the Theory section above, we thus see that a distributed authority being developed through community features ranging from links from trusted blogs to citation of the peer-reviewed scientific literature. A network strategy of constructing credibility is thus used (Flanagin et al. 2008). Bloggers' reliance on other members of the community to correct unwise statements– serving as a sort of informal peer-review – was mentioned explicitly by some participants.

Without being able to rely on centralised resources such as professional bodies to provide legitimation, this boundary work has to be built up discursively through novel techniques and adherence to perceived scientific norms and structures, which simultaneously made bloggers question some of the traditional boundaries of what makes a good science writer. The emergent Mertonian-style norm of universalism (Merton 1973) we have seen crystallise as one of the bloggers' legitimation strategies suggests that the complex identity-management of voluntarily adhering to what here are widely regarded as non-negotiable scientific norms lets anyone (regardless of their credentialed scientific status) be part of a wider scientific identity through adhering to the group values. Universalism thus becomes one of the ideational boundary markers that delineates good from bad science (Riesch 2010). The boundary work can therefore be seen as developing an emerging group identity that sets itself up in opposition to 'bad' or 'pseudo' science, enhancing ingroup cohesion, but without individuals necessarily reaping symbolic or actual institutional rewards other than the personal satisfaction of fighting against 'bad science' as signified in the activism this community engages in.

Blogging activism

While the 'badscience' blogs clearly include discussion of research, personal lives etc., they are distinguished from other science blogging – and grounded by - a more activist focus. Research is not only studied due to an interest in the research itself (although this can clearly be a motivation). Instead, research is also analysed because of what it can be used to do (for example, to challenge problematic government policies or 'pseudoscience'). One blogger, for example, emphasises how their 'activities have been largely responsible for shutting down BSc degrees in various forms of quackery (ed at Salford, Univ Central Lancs, and most recently University of Buckingham).'

Many of the bloggers participating in this research report involvement in activism where they tried to use their blogging to achieve particular ends. Libel laws were significant in this activism. Four bloggers report involvement in 'Streisand Effect'[13] type responses by reproducing posts which other bloggers or writers had to take down due to libel threats. Three have contacted politicians and two have campaigned against 'alternative' medicine in universities. Two participants also report public speaking as part of their activism.

This activism means that the community is necessarily outwards-looking, with some significant impacts upon how bloggers think about the community and its achievements. When asked if there was anything else we should have asked in the questionnaire we used for this project, Science Punk argued that 'I think the failure of science bloggers to properly assess the limits of their reach and impact is unfortunate' and 'You might have asked what efforts bloggers make to ensure their work is seen by people outside of the white/middle class/college educated bracket most of us fall into.'

One significant example of community activism is the use of the Streisand Effect, alongside other efforts, in the community's response to the BCA's libel action against the science writer Simon Singh. Though the details of this case are beyond our scope here, the 'badscience' community's response was interesting. The response took at least three different forms, depending on how much involvement the blogger wanted to devote to this. Requiring the least effort was simply reproducing the offending article on their blog, so that even though the *Guardian* had removed it, interested readers could still find Singh's original article and judge it for themselves (an activity which they consciously referred to as the 'Streisand Effect'). Others scoured the academic literature on the effectiveness of chiropractic and in particular those of the profession's claims criticised by Singh, which they then worked to examine, dissect and explain (often in great detail). As the case wore on, and more knowledge of libel law was needed, bloggers who specialise in legal issues – in particular Jack of Kent – became very active in the community as well. The merits and demerits of the legal case were discussed at great length alongside the scientific evidence.

A number of bloggers went further by painstakingly sifting through the General Chiropractic Council's (GCC) code of conduct and reporting every single chiropractor in the country who appeared to fall short. This kind of 'nuisance activism' did not just remind the chiropractic community that it had significant internal issues to deal with, but also showed them that using libel laws in an attempt to limit scientific discourse can backfire. There is the risk that libel action can draw unwanted attention to a group's activities and create significant problems for them. This 'nuisance' was also tied in with principles of the 'badscience' community, as their complaints tended to focus on chiropractors making claims that lacked a good evidence base.

Another example of activism was engagement with and criticism of Green Party of England and Wales science policy by some community bloggers. This led to considerable debate about such policy and to some modest reforms, including the removal of the demand all scientists and technologists 'take an oath to respect the Earth.'[14] As one of the respondents remembers the episode, 'by looking at evidence, bloggers exposed the Greens' hand-wavey, woffly policy and IMHO pig-ignorance on scientific issues. Mainstream journalists seemed unaware of the issue.' This activity led, among other things, to the blogger *layscientist* speaking at the Green Party conference fringe and to discussion in the *Guardian*. Science Punk notes that 'Gimpy's blog was quite instrumental in raising the Green issues.'

The engagement with the Green Party might be seen as an example of the successes of science blogging. Bloggers were able to take part in the party conference and to put their point of view to the delegates. On the other hand, the changes were often fairly symbolic and did not go so far as many bloggers would have hoped. The comparatively small size of the Green Party may also have been an issue here, and it is not clear whether larger parties would have offered a similar response.

There are also some questions remaining about the effectiveness of the activism against the BCA in the Singh libel case. While the bloggers' activities certainly did cause concern at the BCA and with individual practitioners, there has not been research to show whether these activities influenced public perception of chiropractic or had any effect on public trust in the BCA. Considering that the fight against 'quacks' is so prominent among the motivations of the bloggers, this may be somewhat disheartening. However, it can be argued that the bloggers ultimately had an effect on the outcome of the case. Although the BCA do not (understandably) make it clear, the added public attention as well as the ease with which Singh's original article could be found on a myriad of blogs seems a likely factor in their decision to finally withdraw the case. The bloggers ensured that – rather than silencing Singh – the libel threat paradoxically led to greater dissemination of Singh's criticism, along with many new arguments made against chiropractors. It was therefore somewhat counterproductive for the BCA.

The lawyers Robert Dougans and David Allen Green have noted the importance of the way that 'those following the case on the internet were able to demolish the central element of the British Chiropractic Association's (BCA's) case long before it was able to reach the courtroom.' They suggest that

> The nature of blogging is that it is occasional and voluntary, so it cannot be taken for granted in the same way that traditional PR will exploit the mainstream media. However, should the blogosphere get engaged with a case, the parties can expect the dynamics of the case to be affected - and in a manner beyond their control. This is especially true if the blogosphere chooses to undermine or endorse detailed evidence crucial to a case (Dougans and Green 2010).

However, while this kind of activism is seen as important within the community, participants differed as to their advice to other bloggers and to what were seen as appropriate community norms. Two respondents argued that blogging should be more activist, with one stating that 'if it's worth shouting at the telly about a stupid ad, it's worth filling in an ASA [Advertising Standards Agency] form about it, not too hard to do.' Two bloggers argued that the current balance was about right and four argued that this should be up to the blogger. There may though be a move to an increasing prominence of activism. One blogger suggests that

> I think [blogging] will become more and more activism-orientated. Otherwise, unless you are a particularly good writer, with a knack for getting a thought-provoking unique angle on public domain stories, your blog will be drowned out by the noise of other bloggers and online MSM [mainstream media] outlets saying the same thing. If online content starts to demand a premium, the more 'parasitic' blogs will wither.[15]

However, online spaces can open up both opportunities and problems for this community. When asked what might have stopped them from taking part in activism one blogger referred to 'Depression & apathy, mostly there's so much crap out there'. Another participant argued that our research

> assumes that science blogs don't have a negative impact on science, health and technology policies... Which may not be the case. The accusation could be raised that by speaking out with in some cases real venom about homeopathy etc science blogs actually damage peoples view of science.

The activist focus of the 'badscience' blog community can be seen as resonating with ideas of the 'skeptic' community (Hess 1993) which has a traditional focus of arguing against parapsychology and new age thinking. However, in contrast to traditional skeptic science activism, the focus of 'badscience' blogs is more orientated towards different types of opponents, prominently featuring campaigning against repressive libel laws, bad government policies and 'badscience' (especially where this is commercially exploited, as in the case of large companies selling homeopathic pills and nutritional supplements). This represents therefore a different, possibly uniquely British, kind of 'skeptic' or 'critical thinking' movement which reacts to slightly different concerns relevant within the UK public landscape of harsher libel laws, specific UK political issues and prominent UK media 'experts'. This demonstrates that – despite the potentially global reach of blogs - discussions and networks can remain very national and local in character.

It is this activism element which defines the 'badscience' community more than other groups of science bloggers and which arguably helped build up a cohesive community feel. Through their activism the bloggers are maintaining a boundary between their 'good' interpretation of science and the 'bad' science they are arguing against. They do so in ways that are comparable to the boundary and community identification work that has been observed in other outlets of popular science writing (e.g. Riesch 2010; Leane 2007; Cassidy 2006; Nieman 2000) but which have novel aspects, responding to the peculiarities of blogging as a form of science writing and to the novel risks it brings. This boundary, like the universalism discussed above, acts as an identity marker for the community (Riesch 2010).

Risks of blogging and protective measures

With conflict playing a significant role in this type of activism, bloggers have also developed ways to protect themselves. There is a fairly even split between participants who do and do not blog anonymously. Five do not blog anonymously and three 'anonymous' bloggers point out that it would not be hard to work out who they are. Discussing why they blogged anonymously, five participants raised career-related reasons. Two participants cited concerns about retaliation for their blogging, arguing that 'petty slights can be paid back ten-fold by those with institutional power', 'my managers might not be too pleased at some of the things I say' and that 'Writing a blog slating a customer's product line is not smart business!' One participant

described their anonymity as a way ‘to distance my professional role from my blogging opinion.’ Brainduck noted that they ‘prefer to separate “stupid things I said once” from what my patients know about me’ and also argued that a pseudonym is a good way to allow their writing to be found because ‘I've a common name, it's much easier to find 'brainduck' on Google than the right [name redacted].’ James Cole (JDC325)[16] – describing why he no longer blogs anonymously – argues that

> I feel that anonymity is a stick that people will use to beat you with insinuating sinister reasons for your anonymity…I feel this is unfair as people should be capable of judging what is said without knowing who said it…I would also say that it is difficult to maintain.

Anonymity can also have interesting effects in terms of interactions and community. One anonymous blogger stated that, in order to reduce the risk of their anonymity being breached, ‘I don't interact with other bloggers much – I prefer to remain anonymous.’

A major reason for anonymity was the risk of libel. This was a significant concern among participants, even those that do not blog anonymously. Five participants have had libel threats and seven noted their concern. This concern was often connected with broader criticisms of libel law in the UK. For example, it was argued that ‘Given the experiences of Simon Singh and Ben Goldacre, all bloggers should be concerned about libel action. Britain's libel laws are far to be repressive and are frequently used by the wealthy and powerful to silence critics.’ One blogger also raised concerns about retributions via a complaint to their professional body.[17]

Without the safety blanket afforded to professional science writers and scientists through institutional support should their activities invite legal challenges, bloggers have to negotiate the risks of science activism very carefully. The distributed authority which we analysed earlier as a legitimation strategy for knowledge claims also provides the bloggers with a distributed risk because there is an element of safety in numbers, as the Streisand effect demonstrates. This, coupled with their version of universalism, provides a rhetorical strategy which signals to potential legal challengers that bloggers are firmly on the side of science by ‘letting the facts speak for themselves’ and which, as a group norm shared with the wider scientific community, signals that any challenge to them is simultaneously a challenge to the

wider scientific community and associated ways of knowing and doing things. The anonymity of some of the bloggers and the universalist norm that characterises the collective identity of the community combine to create a necessity to build networked credibility constructions, in order to compensate for more problematic 'source' and 'media' credibilities (Flanagin et al. 2008). This then demonstrates the importance of networked social endorsements within blogging – and within science blogging in particular. These endorsements have the added advantage of spreading any risks among a larger group.

Conclusions

The paper has looked at some of the current discussion of science blogs and grounded this in a case study of the 'badscience' blog community. What we found was that a diverse virtual community (with some face-to-face contacts and links to particular 'non-virtual' places) has been created. There is a complex relationship between blogging and this community, with processes of blogging playing a significant role in constructing this community (as discussed above) but with this community of bloggers then able to use these and other tools in order to act as a community within both virtual and 'meatspace' places.

While most previous studies of science blogging have focussed on blogs by either scientists or professional journalists/writers we have found that this community included, and actively embraced, amateur bloggers who have no strong professional connection to either science or journalism. This, as well as anonymous blogging, has created challenges in terms of authority construction which have been addressed through the construction of a networked and distributed credibility that participants have compared to 'informal peer-review'. This gives a special emphasis on the blogger being part of a blogging community and clustering into clear communities which, as Bell (2012) has remarked, seems a feature that is particularly pronounced in science blogging and may be a result of the additional challenges of authority construction faced by science bloggers.

The community has used blogs in order to engage with the public, politicians and the mainstream media (insofar as the community are separate from the mainstream media) in novel ways. However the nature of this often combative and challenging activism brings risks, often in the form of libel threats from those that are

discussed as peddling ‘bad science’. This drives many bloggers into anonymity and makes networked authority construction especially important for the maintenance of credibility and the minimisation of risks.

Boundary work is being performed through this activism. There are prominent processes of outgroup construction, which are especially noticeable given the ‘bad science’ name of this community. The community constructs a recognisable outgroup of ‘pseudoscientists’ who form a focus for their activism, as well as grounding their blogs within a wider shared concept of the scientific community. The ingroup is – as noted above – more diverse and loosely defined, and is able to retain coherence in part due to outgroup construction.

In the absence of being able to rely on their own authorial authority, this is being achieved through the development of networked authority as described by Flanagin et al. (2008). This takes the form of linking to sources wherever possible and being linked to by others, relying on the community of commenters and twitter followers to point out when community-members get things wrong (which has been described as 'informal peer-review', thus consciously echoing the processes of academic science) and informal discussions with other bloggers. This networked authority maps onto the scientific norms such as universalism which we found are seen as defining values for both science and good science blogging. The voice of authority, the 'source' credibility of traditional rhetorics, has therefore become the community rather than the individual blogger, and helps the bloggers build and maintain the boundary between science and ‘bad’ or pseudo science, since the ‘badscience’ blogs community is being subsumed into a wider group identification with science at large.

The motivations behind this may seem puzzling since, with a few exceptions, bloggers do not directly benefit themselves from their science activism and boundary work. However, it is helpful here to refer back to Hine’s (2000, 148) point that ‘why do they do it’ can seem ‘bizarre’ without shared understandings.[18] These understandings helped to give meaning to the activities that community members were engaging in, with practises of altruistic behaviour connected to a community identity that links in to ideas of science and evidence. 'Doing their bit' in terms of science activism becomes part of both identity and motivation.

The key question that remains is what blogs have achieved and can achieve in terms of the community’s own declared aims of science activism, its reach (as queried

by Science Punk above) and its relevance to science more generally. In terms of broader political engagement, challenges to the Green Party of England and Wales led to some symbolic changes and to some revisions of their website, but other aspects of their policy – for example, the long-held belief that animal research is unnecessary in science and even counter-productive – have not changed in ways that science bloggers were advocating for. Even where blogging and broader campaigns have drawn promises from political parties, there are questions (as with many other areas of politics) regarding the extent to which political parties have remained faithful to their pre-election statements about science and evidence.

There are, nonetheless, some remarkable successes. The ease with which bloggers can share information and resources aids in the online activism they participate in. For example they can co-ordinate complaints to the GCC or Advertising Standards Agency and mirror blog entries which had been removed by the original author due to libel threats to their hosts. Several bloggers have managed to write for the mainstream press on the back of their successful blogging and thus potentially achieved a greater audience for their views, while other bloggers have achieved discussion of their views in the mainstream media and in other prominent venues. The closure of several alternative medicine courses at universities in Britain has been attributed by some to David Colquhoun's blog-led online campaign (though Colquhoun's campaigning also featured more traditional tactics such as writing to *Times Higher Education* and senior university management). Blogs may have helped to change the environment in which some issues are discussed.

While scepticism and caution about future developments remains important, the surprising successes achieved by bloggers in other fields should remind one to remain open to the possibility that these tools might be able to achieve considerably greater impact in future. For example, blogs might draw the mainstream media's attention to scientific topics, co-ordinate the fight against perceived 'pseudosciences' or help launch the media career of individual bloggers, all of which we found were goals often successfully pursued by the 'badscience' bloggers.

As a part of scientific culture, blogs are here to stay for the foreseeable future – writing a blog is an easy way for a scientist to fulfil public engagement requirements, and there is general enthusiasm towards blogging as a direct way of engaging with the public. However, while this may be a feature of this particular community, institutional requirements for public engagement were not a reason that

any community members cited for taking up blogging. Furthermore the mix of backgrounds of our respondents has shown that it is not just scientists who can write science blogs and do so successfully, thus adding a novel dimension to blogging as a two-way dialogue between scientists and non-scientists that other science writing does not offer. The public engagement angle that drives much of the enthusiasm from scientists towards blogging (as briefly reviewed above) may cause commentators to overlook that science blogging can also be an activity where practitioners need to negotiate the often-tricky issues of authority, risk and how to approach science activism without the institutional support available to professionals. In this sense, some science blogging – certainly blogging of the 'badscience' variety – may be more fragile than the institutional enthusiasm would suggest.

It is also less clear whether blogging will go on to have a larger impact on science and its relation to the public. As the reflections from the 'badscience' bloggers suggest, blogs may reach mainly those who already hold similar views and there is a risk that engagement with those who disagree often results in exchange of insults rather than deliberation (echoing Lawrence et al.'s 2010 study of political blogs, although the Singh libel case suggests that even quite antagonistic relations around science blogging can help generate interesting outcomes). The direct impact of science blogging on scientific culture and on society and politics more broadly is therefore uncertain. However, our research indicates that novel and potentially significant practices here do merit consideration.

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1 See Colson (896-7) for a discussion of how certain journalists draw on these factors in assessing a blog's credibility.

2 http://www.bbc.co.uk/blogs/banggoesthetheory/

3 http://ihrr.wordpress.com/

4 http://scienceblog.cancerresearchuk.org/

5 http://jackofkent.blogspot.com/

6 http://www.guardian.co.uk/profile/grrlscientist (formerly at http://scienceblogs.com/grrlscientist/)

7 Even with more 'personal' blogs, the type of broader engagements offered here suggests that these science blogs differ substantially in their relationship to their audiences from the type of personal blogs researched by Brake (2009). Rather than writing 'as if nobody's reading' (Brake 2009, 119), these science blogs are written within the context of broad cultural norms regarding understandings of research and evidence and tend to assume that readers share – or at least can engage with – similar norms. In the case of the bad science blogs we analyse here, the blogs – even the more personal ones – also engage with broader social and political goals such as challenging 'pseudoscience': it is a case of writing as if someone is reading, even if readership is thought or known to be small.

8 http://web.archive.org/web/20060210073921/www.badscience.net/?p=191

9 Echoing our earlier remarks regarding crossovers between different communities, the authors of this article have also been involved in a limited amount of mainstream media work and in online public engagement work and research tied to academic institutions.

10 We need to stress however, that despite us being part of the community, the opinions reported in this paper (for example about homeopathy or the use of animals in research) remain those of the bloggers we interacted with and are not necessarily shared by us. We should also note that this is a diverse community and that community members themselves will hold differing opinions on numerous issues.

11 http://brainduck.wordpress.com/2008/01/14/brainduck-has-moved/

12 Comments recalled ranged from criticisms of a perceived defensive tone to accusations of being an 'ivory tower' academic to the memorable 'ARE YOU A CHICKEN FLAVORED NIPPLE BISCUIT'.

13 The ‘Streisand Effect’ is named after a notorious incident in 2003 when the singer Barbara Streisand unsuccessfully tried to legally block the online publication of a photograph of her home. This action however only managed to draw heightened attention to the picture, thus achieving the precise opposite of what she intended. The term is now used in situations where content that people try to suppress tends to crop up in different places and where moreover the very attempt to suppress makes matters worse by drawing attention to it.

14 http://brightgreenscotland.org/index.php/2010/02/green-party-conference-day-1-science-and-inequality/

15 It was also argued that ‘There can be an element of “me too” activism (which I'm guilty of myself with the [chiropractic] issue) which does run the risk of blowing an issue out of proportion.’

16 James’ name is included here at his request.

17 After the survey was completed, the bad science forum member ‘jonas’ was subject to a Health and Care Professions Council (HPC) Caution Order, following a complaint to the HPC. The Panel found that his forum comments had “failed to keep high standards of personal conduct as well as professional conduct and his behaviour fell short of what would be proper in the circumstances.” http://www.hpc-uk.org/complaints/hearings/index.asp?id=2556&month=12&year=2011&EventType=H

18 In terms of reflexivity, it is worth noting that one of the authors is completing these revisions on a sunny weekend afternoon, having recently had their weekdays filled by various bits of unpaid work (for example, doctoral student training). While such work patterns are not unfamiliar to academics, ‘why *we* do it’ may itself seem odd to those working in different sectors!

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